TPMC
Theta Pro2Serve Management Company, LLC

Environmental Management & Enrichment Facilities

Cold Standby Shutdown and Transition Planning

Infrastructure Roadmap

Portsmouth Gaseous Diffusion Plant, Piketon, Ohio

Portsmouth / Paducah Project Office
PPPO

Managed by
Theta Pro2Serve Management Company, LLC
the Portsmouth/Paducah Project Office
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Cold Standby Shutdown And Transition Planning

Infrastructure Roadmap at the Portsmouth Gaseous Diffusion Plant Piketon, Ohio

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Portsmouth/Paducah Project Office

THETA PRO2SERVE MANAGEMENT COMPANY, LLC
managing the
Infrastructure Activities at the
Portsmouth Gaseous Diffusion Plant
under contract DE-AC24-05OH20193
for the
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ACRONYMS

ACP	Advanced Centrifuge Plant
ACR	area control room
AHJ	authority having jurisdiction
CAAS	criticality accident alarm system
CSB	cold standby
CSD	cold shutdown
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
FY	fiscal year
GCEP	Gas Centrifuge Enrichment Plant
GDP	gaseous diffusion plant
HVAC	heating, ventilation, air conditioning
NDA	non-destructive analysis
NRC	Nuclear Regulatory Commission
OH	overhead
OVEC	Ohio Valley Electric Company
PORTS	Portsmouth Gaseous Diffusion Plant
PPE	personal protective equipment
RCW	recirculating cooling water
ROM	rough order of magnitude
S&M	surveillance and maintenance
UDS	Uranium Disposition Services
USEC	United States Enrichment Corporation

EXECUTIVE SUMMARY

This report summarizes a cost effective course of action or roadmap to be taken with the Portsmouth Gaseous Diffusion Plant (PORTS) utilities and other infrastructure items as the facility moves from "Cold Standby" (CSB) to and through decontamination and decommissioning (D&D).

With a few exceptions, the PORTS utilities and power systems are antiquated, greatly oversized, and usually overstaffed for current and projected demands, and are in a general state of atrophy. The ongoing costs of operating the utilities and power systems total nearly $30M/year not including purchase of power. Opportunities to reduce costs while continuing to supply today's needs were shown through a series of Theta Pro2Serve Management Company LLC (TPMC)/PORTS studies to be $4M/year ($5.4M/year including non-utilities savings) with a one-time expenditure of $2.3M. Of the $4M/year, savings of $2.9/year ($3.3M/year including non-utilities savings) can be realized with essentially no expenditure and the payback is immediate. When the United States Enrichment Corporation (USEC) programs of uranium deposit and technetium (Tc^{99}) removal are complete, an additional $17.8M/year can be saved with a one-time expenditure of $1.1M to enable partial or total shutdown of most utilities. Demand for utilities and power operations during D&D is expected to cost $8.3M/year initially, and then diminish as D&D is completed. This cost progression is shown in Fig. ES.1. Additional savings opportunities of $4M/year have been identified with the installation of dry pipe sprinkler systems in the X-326 and X-330 buildings with an associated one-time expenditure of $28.3M and a payback of seven years. Relocation of the security fence could save $54M during D&D with a one-time expenditure of $1.4M.

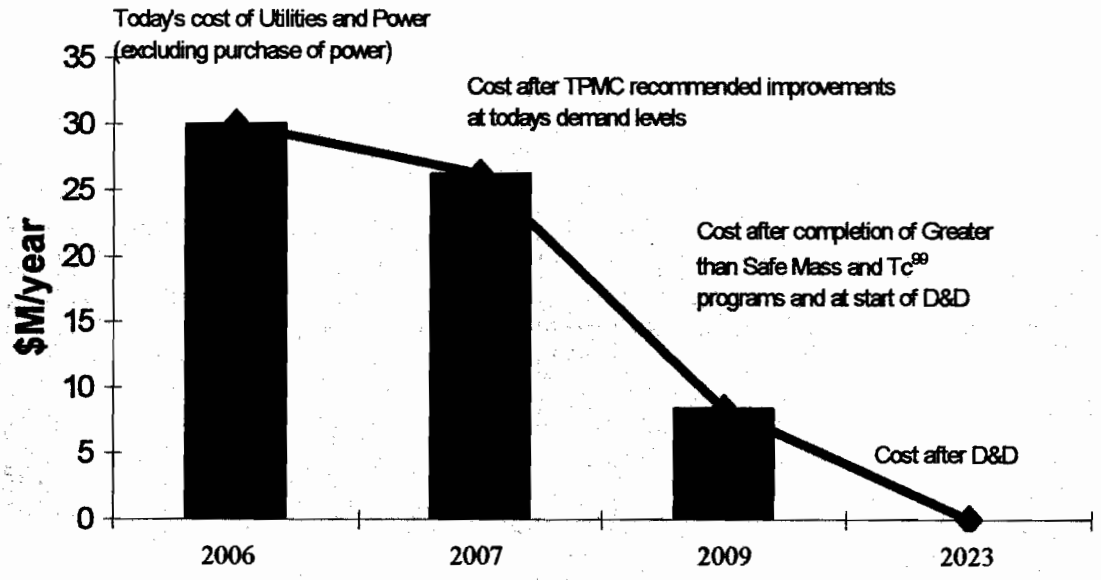


Fig. ES1. Infrastructure cost progression.

A roadmap or strategy for going forward with the PORTS infrastructure is described in this report that postures the U. S. Department of Energy (DOE) to begin and conduct D&D with a minimum of infrastructure related cost and schedule impacts. In addition to de-powering utilities, this roadmap

includes plans for strategically populating facilities, shrinking the plant-site controlled security access area, preparing a site for D&D contractor housing, and removing/relocating plant records.

It is recommended that the short term savings be used to fund the engineering and other preliminary work to allow the following activities to commence:

- Assess need for fire suppression sprinklers remaining activated in vacated buildings awaiting D&D;
- Plan and design a new recirculating cooling water (RCW) blow-down route from the X-6000;
- Ascertain availability of a simpler and less expensive Criticality Accident Alarm System (CAAS);
- Plan and design an alternate heating and cooling for strategically populated facilities and alternate heating for those needing freeze protection;
- Plan and design alternate auxiliary power feeder from the X-530;
- Negotiate with the Ohio Valley Electric Corporation (OVEC) or another utility provider the long-term best configuration and ownership of the X-530 high voltage switchyard and design changes;
- Negotiate with local municipal and county water suppliers the feasibility and cost of supplying potable water and design changes needed to implement;
- Plan for and begin in earnest the process of sending classified and other records off site;
- Plan and design the revised controlled access fence around process buildings; and
- Plan and design a site for D&D contractor trailer location.

1. PURPOSE

This report is the summary with preliminary conclusions from the series of reports developed to document the Portsmouth Gaseous Diffusion Plant (PORTS) "utility systems"' current status and conservation and/or conversion options for transition planning from Cold Standby (CSB) status to Cold Shutdown (CSD) deactivation status. It addresses opportunities for conservation and other savings through operational and other changes while presenting a strategy or roadmap for preparing for diffusion plant and auxiliary systems decontamination and decommissioning (D&D).

2. INTRODUCTION

The Theta Pro2Serve Management Company LLC (TPMC) has analyzed the demand, condition, and ongoing operations of the utilities, power, and other infrastructure systems for PORTS. The results of these efforts are reported in eight CSD and transition planning reports. Systems or structures indirectly analyzed but not covered by separate reports include: records, fencing, and personnel housing.

These studies and evaluations were conducted with the strategic objectives of minimizing ongoing U.S. Department of Energy (DOE) costs while enabling an optimum posture to accommodate and facilitate D&D. With the completion of CSB and the elimination of the need to restart the diffusion process, many steps have been identified that can be taken along this path to save recurring costs while accomplishing de-energization and other preparatory steps toward D&D.

Central to the recommendations from these studies was the requirement to not negatively impact the ongoing DOE-funded, United States Enrichment Corporation (USEC)-conducted programs of deposit removal and technetium (Tc^{99}) cleanup or the USEC, Inc. construction of the lead centrifuge cascade. USEC, Inc. expectations for infrastructure requirements for a full centrifuge deployment within the commercial Advanced Centrifuge Plant (ACP) were generally not provided due to the fact that the economics of operating gaseous diffusion plants (GDPs) oversized, antiquated, and overhead (OH) burdened facilities at relatively low production rates for ACP would be cost disadvantageous without DOE subsidies compared to other alternatives. Other site needs such as DOE programs of remediation, waste management, infrastructure management, Uranium Disposition Services (UDS) construction and operation of a tails reprocessing facility, Ohio Valley Electric Corporation (OVEC), and the Ohio National Guard's continued presence, were considered and accommodated.

The process followed in accomplishing these studies typically included the steps of: operations data review; facility inspections and walk-downs; observations of operations/evolutions; informal discussions with operations, maintenance, and engineering personnel; review of historical documents such as reliability and failure analysis reports where available; limited review of training manuals and the safety analysis report; limited review of project files and drawings for system configuration and past improvements; review of maintenance history and cost records where available; review of invoiced to DOE cost data; and most importantly, a review by peers with extensive firsthand experience with the systems. Projections of anticipated demand based on current and published future needs were made.

Access to operating and maintenance procedures, many drawings, and actual cost data were not available. Projections of when or if facilities will be de-leased (returned) from USEC is problematic to preparing schedules for task accomplishment. In general, it was assumed that after completion of the ongoing USEC projects of deposit removal and Tc^{99} cleanup, any or all leased GDP facilities could be

returned as needed to facilitate future DOE needs. These studies represent the exclusive efforts of TPMC and its subcontractors.

3. GENERAL DESCRIPTION

Essentially all of the facilities and systems reviewed for this series of studies (except the X-6619 Sewage Treatment Plant) were original vintage construction built during the period of 1953 to 1956. Most of the facilities and systems had significant overhauls, upgrades, expansions, renovations, and systematic maintenance to assure reliability and adequate capacity for the Cell Improvement Program/Cell Uprating Program level of GDP needs. In some cases, heightened regulatory requirements have necessitated improvements or changes. All systems are; however, in the same overall condition of minimal operability with failed equipment, degraded cosmetics and housekeeping, disconnected controls and automation, lack of redundant equipment, and with general material condition issues. Current operable capacity is generally only a fraction of installed or design capacity. With few exceptions, all suffer from a general lack of maintenance and custodial care. The reasons for this operable capacity lie with the chain of events of the last five years.

The GDP was shutdown by USEC in 2001 for economic reasons. To assure the ability to restart in the event of increased needs for enriched uranium, DOE placed the majority of the cells and supporting equipment in standby mode with USEC as the custodial contractor. Incumbent upon this mode was that the plant must be able to be restarted and a production level of three million separative work units per year restored within 18 to 24 months. A comprehensive list of requirements for maintaining equipment in an operable condition was established and was used variously as performance criteria for the DOE/USEC contract. Since the restart production criteria was less than 40% of the plant design capacity, a large amount of equipment including utilities and auxiliaries was allowed to atrophy while still meeting the restart production requirement. Thus, most of the equipment and facilities received little or no attention.

Two major DOE-funded programs are being conducted by USEC that require and still will require a significant amount of infrastructure support. These are: (1) the removal of greater than safe mass/planned expeditious handling uranium deposits from cascade equipment using chemical and other means, and (2) the removal of Tc^{99} from cylinders of uranium hexafluoride (UF_6) feed materials. Essentially, every utility system and facility has some small demand placed on it as a result of these two programs as currently conducted and the CSD program.

In 2005, DOE decided to terminate the CSB mode of operation and begin preparing for ultimate D&D of the GDP site (CSD). Knowing that costly to maintain and operate overcapacity exists in all utility systems to meet the long-term needs at the site and that minimizing or eliminating systems from service will simplify, heighten safety, and accelerate the D&D process, a process of identifying the best path forward for each of these systems was undertaken by TPMC under contract to DOE.

4. CURRENT OPERATIONS ANALYSIS AND COSTS

Utilities and power operations data were analyzed over recent years to get baseline performance information and costs. The period encompassing much of the DOE Fiscal Year (FY) 2005 was considered representative of future conditions unless significant information to the contrary existed. This period is used for most data as the baseline. These studies were accomplished during the six-month period from

July 2005 through December 2005. Various power costs were used during the conduct of these studies due to the considerable volatility of the actual and projected future power costs. To be consistent, a normalized value of $73/mWh ($50 OVEC + $23 USEC) was used for this report. Also, the cost of any labor supplied by USEC was valued at $110/manhour (mh). Cost of USEC-purchased items had to be estimated based on publicly available information (internet and other vendors) or was obtained anecdotally. Overhead rates were usually back calculated from total enterprise cost information and all known cost roll-ups. Major cost categories for each utility included: (1) operations manpower; (2) maintenance manpower and materials; (3) procured chemicals; (4) power used by the utility (except power operations); (5) major consumables or services purchased such as coal, diesel fuel, liquid nitrogen (LN_2), sludge disposal; and (6) a miscellaneous category that would include OH and difficult–to-quantify costs. Detailed explanations of determined production rates, component costs, and analysis methodologies are available in each of the individual reports. Not counting DOE purchased power, the utilities and power enterprise has a yearly cost total of ~$30 million. This cost is divided among the six categories as shown in Fig. 1. A summary of current performance and staffing levels, along with major category costs are given in Table 1 of this report.

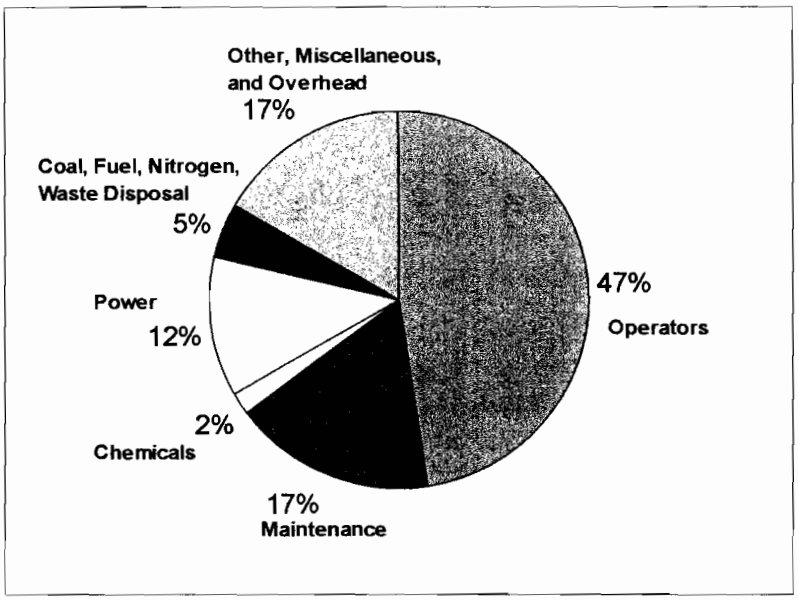


Fig. 1. Cost components of utilities and power.

5. SAVINGS PRIOR TO COMPLETION OF PROGRAMS

There are significant opportunities ($4M/year or $5.4M/year including power) to conserve and otherwise save prior to USEC completing the deposit removal and Tc^{99} cleanup programs. These savings generally do not involve manpower reductions except where a facility or system can clearly be shown to be closed. These savings are also designed to present opportunities to better posture the GDP for D&D. Since the facilities involved in these changes are expected to remain leased through this period and largely involve operating practices for which USEC has little incentive to change, some form of inducement, incentive, or reimbursement denial would be needed to get them implemented. The opportunities are listed by system/facility in the following sections. An additional study is introduced here involving the High Pressure Fire Water sprinkler system wet-pipe to dry-pipe conversion economics. It is introduced because early conversion of one or more facilities represents a highly attractive approach

Table 1. Utilities and power operations performance and cost matrix ($K)

System	Number of operators/ supervisors	Current production baseline	System capacity	Operations manpower cost*	Maintenance labor and materials cost*	Chemical cost	Electricity cost**	Major consumable cost	Other, misc, OH cost	Total enterprise cost
Recirculating Cooling Water (RCW)	6	85M gal/day	887M gal/day	1373	128	269	1300	-	1350	4420
Power	20	31MW	2250MW	4600	1800	-	***	-	400	6800
Steam	17	82,000 lb/hr	275,000 lb/hr	3890	1728	125	192	1050	615	7600
Dry Air	5	13,500 cfm	47,500 cfm	1143	128	-	1839	118	1612	4840
RCW, Sanitary, and Makeup Water	11.3	3.4M gal/day	40M gal/day	2585	1046	205	253	-	947	5036
Nitrogen	0.5	66 scfm	8000 scfm	114	16	-	-	211	78	419
Sewage	2.3	0.2M gal/day	1.2M gal/day	534	300	1	20	34	-	889
Total	**62**	-	-	**14,239**	**5146**	**600**	**3604**	**1413**	**5002**	**30,004**

*Based on $110/mh.
**Based on $73/mWh.
***Plant-site power cost for FY 2005 was $13,600K and is distributed and charged entirely to customers including other utilities.

for ongoing savings. For a more detailed explanation, analysis, and/or description of each system and of precursor activities to suggested changes, see the reports referenced below.

5.1 RCW SYSTEMS (TPMC 2005a)

Table 2 of this report provides a breakdown of the recommended change, savings, cost, and payback. The total cost reduction potential is $1.8M/year with a cost of $70K.

Table 2. Potential savings from the RCW Systems

Recommended change	Savings	Cost	Payback
Switch from large to small pumps	$401K/year	Nil	Immediate
Combine X-626 and X-630 operation	$540K/year	Nil	Immediate
Operate item #2 as a closed system	$134K/year	Nil	Immediate
Shutdown the X-633 facility	$730K/year	$70K	1.3 months

5.2 SWITCHYARD SYSTEMS (TPMC 2005b)

Table 3 of this report provides a breakdown of the recommended change, savings, cost, and payback. The total cost reduction potential is $2.5M/year (including $1.4M/year power savings) with a cost of $2,246K.

Table 3. Potential savings from the Switchyard Systems

Recommended change	Savings	Cost	Payback
Eliminate unneeded preventive maintenance	$69K/year	Nil	Immediate
Conservation practices	$451K/year	$10K	8 days
Shutdown the X-533 facility	$918K/year	$1480K	19 months
Relocate Power Operations to the X-530	$1050K/year	$756K	9 months

5.3 STEAM SYSTEM (TPMC 2005c)

There are no savings achievable with the X-600 Steam Plant during this time frame due to the need to generate a minimum of 50,000 lbs/hr (one unit operation) to avoid opacity (environmental) exceedances. Current and foreseeable loads during this period are less than 50,000 lbs/hr and such conservation efforts will only result in more excess steam vented and not reduce production or production costs.

5.4 DRY AIR SYSTEMS (TPMC 2005d)

Table 4 of this report provides a breakdown of the recommended change, savings, cost, and payback. The total cost reduction potential is $831K/year with a negligible cost.

Table 4. Potential savings from the Dry Air Systems

Recommended change	Savings	Cost	Payback
Discontinue use of diesels	$118K/year	Nil	Immediate
Revise dew-point to -40^0 F	$93K/year	Nil	Immediate
Repair significant leaks	$26K/year	Nil	Immediate
Remove buffers and blankets from < always safe mass cells	$40K/year	Nil	Immediate
Discontinue dry air on seal labyrinths	$350K/year	Nil	Immediate
Discontinue dry air on unneeded systems	$204K/year	Nil	Immediate

5.5 RAW, SANITARY, AND MAKEUP WATER SYSTEMS (TPMC 2005e)

There is a potential cost reduction of $150K/year with no cost by incorporating conservation/demand reduction.

5.6 PROCESS BUILDING DRY SPRINKLER SYSTEMS (TPMC 2005f)

Table 5 of this report provides a breakdown of the recommended change, savings, cost, and payback. The total cost reduction potential is $4M/year with a cost of $28.3M and a payback of seven years.

Table 5. Potential savings from the Process Building Dry Sprinkler Systems

Recommended change	Savings	Cost	Payback
Convert X-326 to dry-pipe sprinkler. Discontinue electric heating.	$1.88M/year	$13.6M	7 years
Convert the X-330 to dry-pipe sprinkler. Discontinue electric heating.	$2.08M/year	$14.7M	7 years

5.7 NITROGEN SYSTEM (TPMC 2005g)

Table 6 of this report provides a breakdown of the recommended change, savings, cost, and payback. The total cost reduction potential is $98K/year with a negligible cost.

Table 6. Potential savings from the Nitrogen System

Recommended change	Savings	Cost	Payback
Discontinue use of one tank	$65K/year	Nil	Immediate
Switch seal feeds to dry air	$33K/year	Nil	Immediate

5.8 X-6619 SEWAGE TREATMENT FACILITY (TPMC 2005h)

There are no significant savings to be realized with this facility during this time frame. Also, its state-of-the-art technology and good material condition dictates a continued cost effective presence and utilization for site occupants for the foreseeable future.

5.9 SAVINGS ROLL UP

Table 7 of this report summarizes the potential savings to be realized prior to completion of deposit removal and Tc^{99} cleanup program completion.

Table 7. Potential savings prior to the completion of deposit removal and Tc^{99} cleanup

Utility system	Potential yearly savings ($K)	Implementation cost ($K)
RCW	1800	70
Switchyard	1100*	2246
Steam	0	0
Dry Air	831	0
Water	150	0
Nitrogen	98	0
Sewage	0	0
Totals	**3979**	**2316**

* Not including ~ $1400K in power saved by others with implementation. Power Operations is considered a pass-through utility for cost purposes.

Additionally, conversion of wet sprinklers to a dry-pipe design presents a $4M/year savings opportunity at a $28,300K one-time cost.

6. SAVINGS AFTER COMPLETION OF PROGRAMS

6.1 GENERAL DISCUSSION

Upon completion of the deposit removal and Tc^{99} cleanup programs, significant opportunities present themselves for total shutdown of most of the utility systems as a precursor to major facilities D&D. The approach taken is to drive down the need for the utility through conservation and other demand elimination approaches that are cost effective to where the unit cost of providing the utility is cost prohibitive compared to other alternatives. Since most, if not all, of the process related portion of the utility's demand is gone at this time, the residual demand is that associated with the people and programs that remain, the surveillance and maintenance (S&M) of CSD facilities that are awaiting D&D, and the needs of other site residents.

Note: For a utility or facility to remain in service through this period and beyond, it will be expected to clearly and unequivocally be the lowest cost option to DOE.

DOE's needs for this study have been assumed to be the singular determining factor (paramount) for all utility decisions. Other residents (USEC, USEC Inc., UDS, OVEC, Ohio National Guard, LATA/Parallax Portsmouth LLC, TPMC, etc.) and their operations will be expected to bear the fully burdened cost of utilities provided by DOE or have negotiated individual alternative supply arrangements to the contrary (barter agreements, etc.).

In order to make assumptions concerning depopulating and de-energizing facilities, an expected progression and path forward or road map has been developed as to the sequence of events, interrelationships between S&M needs, personnel level and housing needs, safety system needs during D&D, methods of accomplishing D&D, and ultimate end-state objectives for the site. One such path is offered as the basis for planning and estimating and is presented in the following Sect. 6.2 of this report.

6.2 STRATEGY FOR PATH FORWARD

Basic assumptions central to this plan are as follows:

- When the deposit removal and Tc^{99} cleanup projects are complete, most if not all of the USEC employees housed in GDP facilities will either transition to Centrifuge related activities housed on the Gas Centrifuge Enrichment Plant (GCEP) side of the plant, be retained by D&D or pre-D&D activity contractors, or leave the site.

- USEC will de-lease or otherwise make available to DOE the facilities needed for D&D and pre-D&D activities in a timely manner.

- Regulatory oversight transition from the Nuclear Regulatory Commission (NRC) to DOE will occur in a manner and time so as to not preclude this path forward.

- Depopulated facilities remain protected with fire suppression sprinkler (wet or dry) systems unless they are shown by the fire protection authority having jurisdiction (AHJ) and others to meet the following criteria:

- Majority of flammables have been removed;
- All energy sources have been shutoff;
- No significant inaccessible interior areas (buildings within buildings) exist;
- Fires can be extinguished (fought) externally (building small enough);
- Personnel access to the buildings can be controlled (facilities are locked); and
- Not a Category 2 or Category 3 Nuclear Facility.

- Facilities that have historically contained fissile materials and have historically been protected remain protected by the Criticality Accident Alarm System (CAAS) until sweeps can certify they fall below the criteria needing CAAS.

- The existing CAAS cannot cost effectively be replaced and thus its monitoring and calibration facilities must be maintained until sweeps have allowed decertification of all currently monitored facilities.

- All classified materials will be contained inside of a guarded exclusion zone until their disposition.

- Much of the plant records can and will be dispositioned through shipments off site.

- D&D of process buildings will generally be sequenced as the X-333, X-330, and X-326, with the X-326 being the final one completed.

6.3 ROADMAP

The overall major sequence of events from a utilities perspective that culminate in the GDP facilities being turned over to a D&D contractor are as follows: (1) safety basis redefinition; (2) depopulation of major population centers; (3) repopulation of a select few facilities; (4) provision of alternate cooling, heating, and dry air for a select few facilities; (5) major utilities systems partial or total shutdown; (6) fencing changes implemented for streamlined D&D contractor access; and (7) provision of a site for D&D contractor housing.

6.3.1 Safety Basis Redefinition

This step is beyond the scope of this report except to assume that whatever the system of regulatory oversight (DOE or NRC), the ability to accomplish the remaining steps would not be contrary to the authorization basis. Throughout the reports discussed previously in Sects. 5.1 through 5.9, needed changes relating to the authorization basis to permit implementation were discussed. It is believed that the changes prescribed constitute only minor changes usually to the facility description sections of the safety documentation. It is believed that none of the changes prescribed would constitute an un-reviewed safety question or a reduction in the safety margin of the facilities or systems.

6.3.2 Depopulation

With GDP operations complete, the first step on the roadmap is to complete the depopulation of administration and other population center facilities. It is expected that the X-100, X-101, X-102, X-705, X-710, and X-720 buildings would be vacated by USEC early in this process. The rationale and drivers for this expectation are as follows in Sects. 6.3.2.1 through 6.3.2.7 of this report.

6.3.2.1 X-100 Administration Building

It is expected that USEC, Inc. will desire a more substantial facility for their headquarters/administrative offices. The X-100 is inconveniently located to the GCEP facilities. The building is in disrepair with serious habitability (mold) and cosmetic (appearance) issues. It was a temporary structure when built in 1954 and much of the plumbing, heating, and electrical infrastructure is obsolete and failing. Depopulation of this facility will include the removal of USEC records from the central files vault areas of the building. DOE will assume custodianship of records that remain. DOE records will be shipped off site to a federal repository (perhaps in Dayton, Ohio) in a timely manner or be relocated to other approved onsite facilities.

6.3.2.2 X-101 Health Services Building

With declining employment, it is doubtful that continuation of on-site provision of medical services would be cost effective for USEC. Other site-occupants have found lower cost options and do not use the USEC service. It is unlikely that D&D contractors or subcontractors will find this service cost effective. It is expected that this facility will be able to be vacated at an early stage in this process. Emergency response to medical emergencies will continue to be provided by USEC fire services housed in the X-1007.

6.3.2.3 X-102 Cafeteria

This facility will be a luxury as employment numbers decline. Also, as the main population center moves to the GCEP side, it will cease to be convenient to the majority of the plant site. D&D contractor workforce personnel will brown bag or capitalize on mobile food vendors. This facility is currently being minimally utilized.

6.3.2.4 X-705 Decontamination Building

This is one of the most complex and expensive non-process buildings to operate and maintain. This is due primarily to the multitude of complex chemical systems associated with handling and reclaiming of all enrichment levels of uranium bearing materials created when process equipment must be disassembled for repair or rebuild. It also represents one of the greatest nuclear criticality safety challenges due to the handling of uranium bearing liquids and solutions. It houses a laundry for cleaning non-disposable personal protective equipment (PPE) and worker clothing such as coveralls. An annex/addition on the south end serves as a facility for dismantling equipment that poses the risk of significant out-gassing due to greater than normal residual non-hydrolyzed uranium deposits. The need for decontamination of equipment for maintenance rebuild goes away at the completion of deposit removal and Tc^{99} cleanup. Further, the methodology for D&D is expected to include equipment dismantling or decontamination only in the field. Hence, the residual need for the X-705 becomes that of the laundry. Since the D&D workforce is not expected to need launderable PPE and the cost of keeping the building open for any residual GDP or new ACP workforce needs will be exorbitant without DOE subsidy, the laundry function is expected to either be discontinued or be relocated to a GCEP/ACP facility. It is expected that USEC should desire abandoning this facility as early as possible after completion of the DOE-funded programs. Deactivation of this facility will require a significant effort to safely remove hazardous and fissile process materials and render shutdown equipment safe so as not to require a significant level of S&M. DOE planning for this eventuality should begin as soon as possible to avoid cost and delays in facility D&D.

6.3.2.5 X-710 Laboratory Building

This is also a complex and expensive non-process building to operate. Energy needs for the heating, ventilation, and air conditioning (HVAC) are high. Maintaining adequate makeup airflow for hood velocities is problematic. It is expected that retaining the X-710 building for personnel housing will be highly cost prohibitive. Also, it will be inconveniently located with respect to the GCEP facilities. The lab missions associated with the analysis of uranium for the GDP will vanish with the completion of the DOE-funded projects. The laboratory currently does no work for the remediation and environmental missions of the site due to high cost (analysis are competitively bid). Health Physics/Industrial Hygiene analytical needs are or can be met generally in a cost effective manner using off-site labs. It is expected that uranium-related analysis for product certification and process control of the ACP will be accomplished with much less robust, duplicative, and costly facilities. It is also expected that USEC will desire abandoning this facility as early as possible after completion of the DOE-funded programs. Removal of hazardous and fissile process materials from this facility may constitute a non-trivial effort that will take some planning.

6.3.2.6 X-720 Maintenance and Stores Building

This facility is currently utilized primarily for limited personnel housing with a very limited amount of shops activities (weld, carpentry, sheet metal, instrument, machine, electric motor, etc.). Residual shop activities after deposit removal and Tc^{99} cleanup programs completion are expected to be insignificant. Safety Code Inspection has activities that are proportional to USEC activities (slings and lifting fixture inspection and testing) and operational support such as testing pressure relief valves and hydro testing pressure vessels. The GDP need for these functions will essentially disappear with the programs. Residual needs for residual GDP utilities shop support can be subcontracted or conducted in the field. Stores will also disappear with a residual minimal need for utilities and power systems support easily met through relocating pertinent stores to the specific facilities. Classified component storage, if needed, should be relocated to a process building (preferably the X-326). The X-720 building may be an attractive *interim* location for DOE infrastructure contractor management and workforce personnel.

6.3.2.7 Other facilities

There are many other facilities that have minimal personnel in them that will be depopulated at the earliest time frame. Abandoning these facilities does not constitute a personnel housing issue but rather a continued operability or economic convenience issue.

6.3.3 Repopulated and Newly Populated Facilities

Select facilities in the GDP complex will need to retain or gain occupancy at the beginning and throughout the D&D process or until alternative replacements can be provided for. The rationale used in singling out these facilities is that there is no cost effective alternative known at this time for some critical function, and, as such, maximum opportunity should be taken of the heated and/or cooled space available in these facilities. If additional studies are accomplished that reveal cost effective alternatives, methodologies, or approaches, it is possible that these may be depopulated and their use discontinued.

6.3.3.1 X-700 Converter Shop and Cleaning Building

USEC's need for this facility ceases after the DOE funded programs cease. The singular reason for keeping the X-700 building occupied is associated with the CAAS. The CAAS or an approved alternative is expected to remain until essentially all fissile material containing buildings have been D&D'd or

certified as not needing a CAAS. For the CAAS to perform its intended function and to comply with the American National Standards Institute and DOE standards for fissile facilities, the primary scintillation sensors (clusters) must periodically have their performance checked and if needed re-calibrated. For the system currently used, this requires a high-energy neutron source (Californium) and the capability to handle it safely. These provisions have been built into the X-721 Radiation Calibration Facility (Rad Cal) located in the northwest sector of the X-700. It is expected that duplicating this capability elsewhere or installing a replacement CAAS system would be cost prohibitive. There are no known cost effective off-site calibration alternatives. If it is assumed that the heated and air conditioned north section of the building must be maintained in service for the duration of the D&D process, efforts to synergistically utilize the approximately 50,000 ft^2 non-Rad Cal areas becomes attractive. This area is also envisioned to be a potential *interim* location for infrastructure contractor management and workforce personnel.

6.3.3.2 X-300 Plant Control Facility

Like the X-700, this facility's mission is tied to maintaining the CAAS system or an alternative in service. As the central control facility, it is expected to retain central CAAS monitoring throughout the D&D process along with emergency response, public address, fire alarm monitoring, and public warning system control. If, as expected, these functions are deemed too expensive or unreasonable to duplicate or eliminate, the X-300 building needs to remain in service. Steps to provide alternative cooling and heating to the existing RCW and steam-based systems will need to be taken early in the depopulation process. Once taken; however, the X-300 like the X-700 building becomes an attractive location for personnel housing. By removing the process and power control panels, most of the 16,000 ft^2 of floor space can be synergistically used as DOE or contractor offices.

6.3.3.3 X-104/X-106 Guard Headquarters

It is expected that relocating the function of this facility for the duration of the D&D process would be cost prohibitive. This is due to the electronic monitoring and surveillance functions hardwired to the facility. There are no synergistic opportunities envisioned for housing other functions at this facility, due to the secure characteristic this facility requires. Additionally, the facility is at or near capacity with the current guard force.

6.3.3.4 Other facilities

There are a few other small facilities on the GDP site that logically should remain in service that either are populated or are able to be populated at least initially and probably throughout the D&D process. These do not constitute population centers but rather have process operability or economic drivers that dictate that they remain habitable. Examples of these are the X-540 Telephone Exchange Building, the X-640-1 Fire Water Pump Building, and the ground water pump and treat facilities (i.e., X-622, X-623, X-624, etc.).

6.3.4 Provision of Alternate Utilities

A select few facilities will require alternate heating and/or cooling systems if the facilities are to cease being obstacles to total main utility system shutdowns and deactivations. These have been detailed in the individual reports and are summarized as follows in this section.

To determine the need for alternate heating or cooling, facilities have been placed into three categories. They are: (1) facilities that will remain occupied and thus require personnel comfort; (2) facilities that must remain heated to a minimum level (40^0 F) to prevent freezing of wet pipe sprinkler

systems; and (3) facilities that are/will be shutdown and through a fire protection assessment are expected to have been shown to meet the assumptions of Sect. 6.2 and have had their wet pipe sprinkler systems deactivated and drained.

Type 1 facilities include: the X-104, X-300, X-530, X-540, X-700, and perhaps the X-720. These facilities now rely mostly on steam for heating. To permit continued occupancy, they will need electric heaters or electric to water heat exchangers installed. Estimated cost for these changeovers is $800K. The model or methodology for these installations can be found in the XT-847 and X-112 recirculating hot water heater retrofit projects. Type 2 facilities include: the X-342, X-343, X-344, X-533, X-600, X-626, X-630, X-633, X-640-1, X-705, X-710, X-760, and perhaps the X-720. The probable least cost approach to providing the minimum level of short term seasonal peripheral heating is currently used in the X-326, X-330, and X-333 process buildings. If the recommendation in TPMC/PORTS-33 (TPMC 2005f) is followed to install dry-pipe sprinklers in the X-326 and/or X-330, many if not most of the portable heaters needed for periphery heating of these Type 2 facilities would be available at no cost as surplus from the process buildings. Type 3 facilities [those that are felt to not require any heating and that would meet the criteria (see Sect. 6.2, 4th bullet) or already have adequate electric heating] include: the X-100, X-100B, X-101, X-102, X-103, X-105, X-106, X-106B, X-109A, X-334, X-344B, X-344F, X-600B, X-600C, all X-605, X-621, X-622, X-622T, X-623, X-624, X-740, all X-744 (X-744G if uranium materials have been removed), and the X-750.

Alternate cooling systems will be needed in the X-300 and the X-530 facilities. Both facilities can have their cooling needs met with stand alone freon to air heat exchangers attached to existing HVAC systems. Estimated cost of this change would be $80K.

Dry air will need to be provided through small stand-alone compressor/dryer units for Type 1 facilities (listed above) plus the X-326 building. Estimated cost of this provision is $124K.

6.3.5 Utility Systems Partial and Total Shutdowns

When process needs for utilities have been eliminated, people have been removed from supplied facilities, or alternative means of supplying the utility have been satisfied, the utility system can be shut down. Systems to be shut down totally are the RCW, Steam, Nitrogen, and Dry Air. The Raw, Sanitary, and Makeup Water Systems can be partially shut down inasmuch as the distribution piping must continue to be used for potable water supply during D&D and for low pressure fire water. The electrical system will continue to be utilized for the foreseeable future with portions of the X-530 Switchyard remaining in service to supply site residual and ACP demands.

Significant recurring savings are realized with shutting down utilities. Reasons for the savings include reduced electricity consumption, reduced manpower needs, reduced chemical treatment needs, reduced fuel needs, reduced waste or loss, reduced maintenance, and reduced OH and other miscellaneous difficult-to-quantify costs. All of the PORTS utility systems suffer from the same problem that prevents them from being a cost effective supplier of the low residual post shutdown demand. This is the fact that they are sized for plant loads and system demands that are orders of magnitudes larger than any demands existing or foreseeable. This characteristic generally saddles the system with a high fixed cost and a high maintenance component of the variable cost and thus a high unit cost. Unit costs of GDP supplied utilities are generally not expected to be cost attractive to the ACP without DOE subsidies. Recurring long-term savings associated with utility systems partial and total shutdowns are discussed in Sects. 6.3.5.1 through 6.3.5.6.

6.3.5.1 RCW system shutdown

Total shutdown of the RCW system can take place upon installing alternate cooling capabilities for the X-300 and the X-530 facilities and installing a small diameter National Pollution Discharge Elimination System monitored blow-down line jumper from the X-6000 to the existing Scioto River blow-down line. The alternate cooling modifications have been estimated to cost approximately $80K. The blow-down line can originate in the X-7721 (MST) building to minimize length and is estimated to cost $100K. Additional savings with shutting down the remainder of the system after the steps of Sect. 5.1 have been taken is $2.6M/year. Total savings with the RCW system shutdown compared to current day operations are $4.4M/year.

6.3.5.2 Electrical systems shutdown

This study projects a continued D&D need for the X-530 Switchyard as well as an indefinite post-D&D presence and use of portions of the X-530 (the X-533 Switchyard is considered to have been shut down before or shortly after completion of the programs). The reasons for this is that the most reliable means of supplying power to the X-5001 and thus ACP is with the existing underground 345 kV transmission system originating in the X-530. Recreating this capability using overhead transmission lines from existing or new sources is projected to be costly and untimely for the ACP compared to their funding of as much as all of ongoing X-530 operations. Another reason is that even without the presence of GDP-D&D and ACP needs, the X-530 in the absence of the X-533 is a main nexus of interconnectivity for the eastern United States power grid (East Central Area Reliability). If the X-530 is to be D&D'd, its OVEC interconnectivity function would have to be duplicated anew in close proximity to the existing site. Maintaining the X-530 Switchyard in service, even if the upgrades are necessary to comply with power grid requirements, is believed to be the least costly option for OVEC. Operation of the X-530 could undoubtedly be conducted in a more cost effective and reliability compliant manner. It is likely that OVEC will desire to lease or purchase the high voltage section of the yard (all equipment west of the main power transformers). This would require OVEC to arrange for their electrical control of the 345 kV circuit breakers. Ownership of the control circuits for the load side breakers would have to be determined since it is unlikely that they would accept any ownership of the low voltage sections of the yard. Assumption of high voltage yard control by OVEC would relieve DOE of responsibility for complying with newly heightened National Energy Reliability Council and Federal Energy Regulatory Commission reliability standards.

After D&D of the last of the GDP facilities is complete (X-326, X-300, X-700, etc.), the X-530 main power transformers and low voltage (13.8 kV) equipment and buildings can be D&D'd. This would include the X-530B Main Switchyard Control Building and all remaining main power transformers. At this time, any residual loads such as the environmental monitoring stations, pump and treat facilities, and remaining security lighting, if any, will require alternate supplies from either the X-5001 (ACP) or be outsourced to the local public power utility American Electric Power. Except for the small operator contingent required to operate the X-5001 by ACP (and in the future staffed by ACP), no power operations personnel will be needed past this point in time. Savings at this point compared to current practices would amount to $6.8M/year.

6.3.5.3 Steam system shutdown

Total shutdown of the steam plant and distribution system can take place as soon as alternate heating for Type 1 (occupied) and Type 2 (freeze protected) buildings (see Sect. 6.3.4 of this report) has been accomplished. Cost for installing alternate heating in Type 1 facilities is estimated to be $800K. Cost of installing alternative heating in Type 2 facilities is minimal if relocated process building heaters are used. Since no savings have been determined to be achievable before completion of DOE funded USEC

programs, all of the yearly operating costs of the steam plant will be saved upon its shutdown. The total yearly savings with the shutdown of the steam plant and associated distribution systems compared to current day operations is $7.6M/year.

6.3.5.4 Dry air system shutdown

After completion of the DOE-funded programs, shutdown of the GDP dry air plants (compressors/dryers) can take place after conservation efforts and provisions for residual needs have been made. It is expected that several small commercial air compressors with self-contained refrigerated dryers would best meet the remaining demand (approximately 2270 ft^3/min). While unlikely, due to reliability and capacity concerns, it is also possible that this minimum interim demand may be supplied from the X-6000 Dry Air Plant operated for ACP needs. The costs of stand-alone commercially available off-the-shelf compressors have a rough order of magnitude (ROM) cost of $124K. Savings with this approach, after the programs have been completed, is expected to be $4M/year. Total savings with the dry air plant shutdown and conservation compared to current practices is $4.8M/year.

6.3.5.5 Raw, sanitary, and makeup water systems partial shutdown

As the programs are completed and the air conditioner cooling function of the RCW system is eliminated, the need for cooling (makeup) water is eliminated. The sanitary water distribution system must remain in service due to its use as the source of low pressure fire water and for potable water for site residents. Revisions of the treatment process, staffing, and state license to tailor the facility for provision of groundwater sourced drinking water would yield significant savings and come close to making the existing operation cost effective as a long-term site supplier. If further here-to-fore unknown reductions in costs (manpower, power consumption, maintenance, etc.) of the current operations are unable to be made, purchase of potable water from one or more area municipal or county water companies becomes the likely preferred approach. Cost of ongoing operations after implementing all proposed actions and continuing to use the X-611 compared to current practices at the projected demand is $3.25M/year, which is greater than the cost of purchasing water at $1.75M/year. Thus, residual cost of operations is projected to be $1.75M/year. Total savings compared to current practice is $3.3M/year.

6.3.5.6 Nitrogen system shutdown

A total shutdown of the nitrogen distribution system can take place almost immediately after completion of the DOE-funded programs. Needed precursor activities after those associated with the savings of Sect. 5.7 include cross connecting the X-326 nitrogen header to the dry air system and arranging for micro-bulk deliveries of LN_2 for non-destructive analysis (NDA) and residual laboratory needs. With these actions, $310K/year additional will be saved. Total yearly savings with the Nitrogen Distribution System shutdown compared to current practices is $408K/year. Total enterprise cost is not quite saved due to a $12K/year increase in the cost of alternative dry air.

6.3.5.7 Roll Up

Table 8 of this report summarizes the Utilities and Power Operations potential savings after completion of USEC programs

It is at this time following the completion of the deposit removal and Tc^{99} cleanup programs, that the majority of the utilities and power operations personnel will be surplus to the GDP needs.

Table 8. Potential savings after completion of programs

Utility system	Potential yearly savings ($K/year)	Implementation cost ($K)	Remaining at start of D&D ($K/year)
RCW	2800	180	0
Switchyard	0	0	5700
Steam	7600	800	0
Dry Air	4000	124	0
Water	3136	0	1750*
Nitrogen	310	0	12**
Sewage	0	0	889
Total	**17,846**	**1104**	**8351**

* Cost of purchased water
** Cost of replacement air

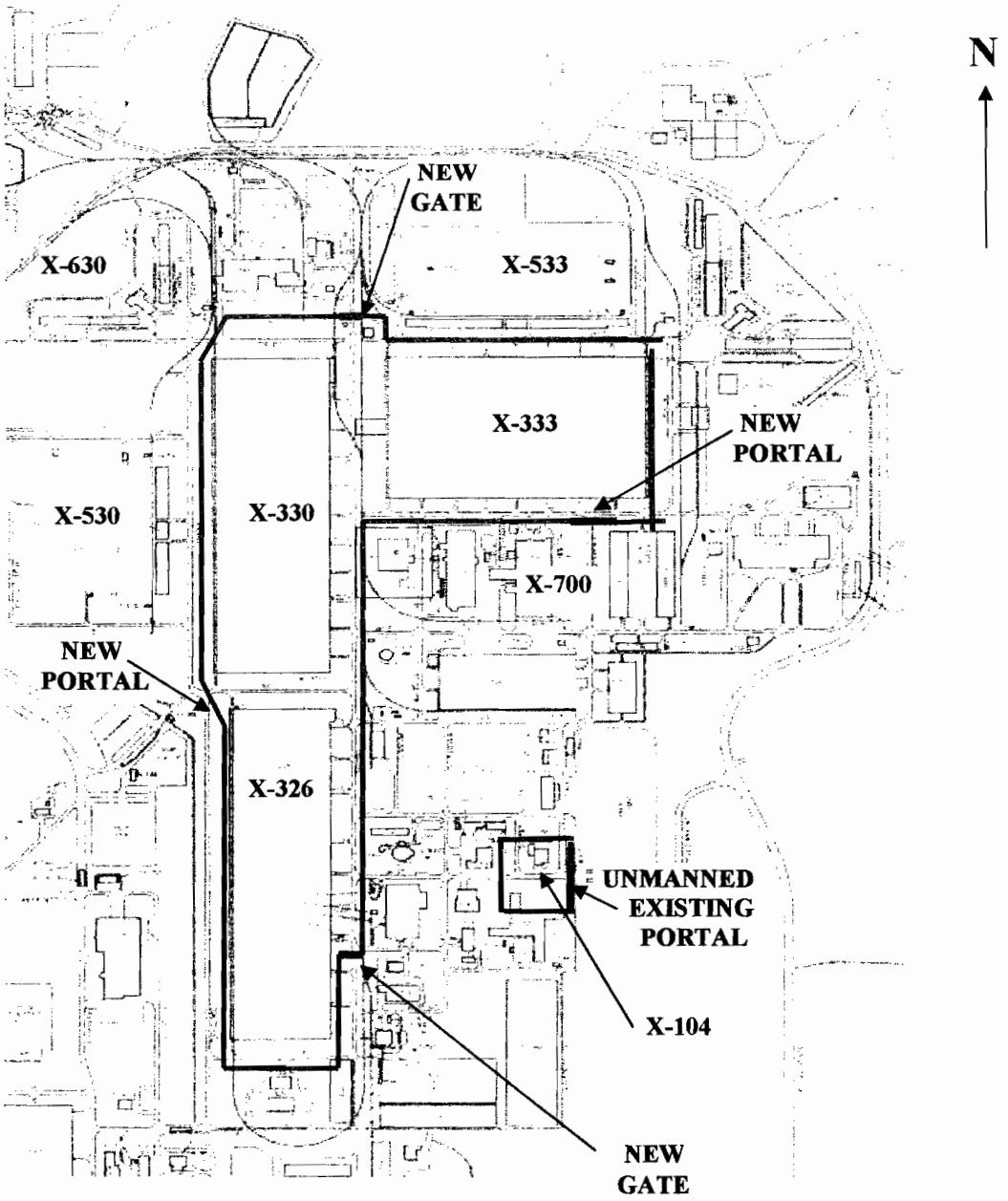
6.3.6 Fencing Changes

It is envisioned that during pre-D&D, classified materials outside of the process buildings that have been identified through security sweeps will be consolidated into one of the three process buildings. The three process buildings will be protected by an access control system (fence) with guarded portals. This would allow access to the non-process buildings to be uncontrolled except for normal industrial type security. Most will be unmanned and locked. Facilities undergoing D&D will be protected by the D&D contractor as needed for construction site safety and security. Greater flexibility of work assignment, more immediate use of newly hired construction personnel, and lower net security costs would be significant potential benefits from these changes. Facilities outside the process building fences could be D&D'd using unescorted and uncleared personnel. Additionally, contractor management and administrative personnel do not generally need access to the classified areas and could be uncleared. To accomplish these objectives, a fence is envisioned around the X-326, X-330, and X-333 process buildings with a minimum of two guarded personnel/equipment portals. New fencing would closely follow existing roads that already have street lighting, but some minimal additional lighting may be needed.

Since electronic ingress/egress controls, surveillance systems, accountability systems, etc. are expected to play a key role in satisfying future site security needs, the ability to monitor existing and future systems from a secure location is needed. This capability is currently provided in the X-104 Guard Headquarters Building. It is anticipated that duplicating this capability including the miles of hardwiring to another facility would be cost prohibitive. Thus a fence surrounding the guard headquarters might be needed.

A sketch showing one such route for the new fence is shown in Fig. 2 of this report. Additional locked gates for emergency vehicle access or occasional equipment removal pathways can be inexpensively added where thought to be needed. One-way rotary gates for emergency personnel egress would be needed. This plan utilizes much of the existing X-326 Special Nuclear Material fencing and lighting. An estimated 14,000 ft of additional fencing would be required to completely enclose the process buildings. At $100/ft, a ROM cost for this change is $1.4M. Savings during D&D with this fence

relocation have been estimated based on eliminating the escort requirement for D&D contractor personnel working outside the new fence. Based on a customized security plan escort requirement of 1 for every 5, as much as 17% of the D&D field labor man-hours can be saved. D&D field labor cost per ft^2 of facility is calculated from the ongoing Inactive Facilities Removal Project (Work Breakdown Structure 1.12.05.04.03.01) to be $\$107/ft^2$. Thus as much as $\$18/ft^2$ D&D cost could be saved by not using escorts. For the ~3M ft^2 of buildings outside of the proposed fence this savings would amount to \$54M.



Notes:
1. The existing Limited Area fence is abandoned except for X-104.
2. There are two portals and two gates into the D&D Controlled Access Area.
3. The X-326, X-330, and X-333 are within the D&D Controlled Access Area.

Fig. 2. Proposed D&D controlled access area boundary.

6.3.7 Provision for D&D Contractor Housing - Trailer City

With the exception of DOE and infrastructure management contractor personnel, GDP site population is anticipated to be predominately D&D contractor(s) and subcontractors. This group of people will be transient with somewhat fluctuating levels throughout the D&D process. Since the goal is to free up for demolition as many facilities as is possible, provision of hardened housing for the D&D contractors is considered unwise. The most cost effective and flexible approach to meeting this need is to require the contractors to supply their own trailer housing as they see fit or need. DOE should provide a hard surface (concrete), a reasonably close proximity to a sanitary sewer (lift station), a location to connect to the potable water system, and minimal metered electric service at 220/110 volts. Low cost locations that fit this need would be any of the concrete pads on which existing warehouses now stand. Since warehouses are a prime candidate for early demolition, the pads that remain could be available for this purpose at an early date in the process. On the West side of the plant, former Lithium storage warehouses X-744S, X-744T, and X-744U would be a location easily made available. These collectively cover 150,000 ft^2 and could easily accommodate 50 or more 14 ft x 70 ft office trailers including provisions for fire lanes and parking spaces. If a location closer to the GDP buildings is desired, pads under warehouses X-744J, X-744H, and X-744L comprising 176,000 ft^2 that would accommodate an even greater number of trailers could be used. Both locations are reasonably close to needed utilities. If the second location is the site of choice, removal of warehouse contents would be a complicating precursor but an activity that could begin immediately and that needs to be accomplished in any case.

6.3.8 Document and Records Removal and Relocation

Ideally, the majority of DOE owned site records can be removed from the X-100 vaults and other GDP record centers and shipped directly to a federal records depository (Dayton, Ohio, or other). Anecdotal information on a recent effort by a USEC contractor to send records to the Dayton center gives a benchmark of the effort associated with the process. In this case, an estimated 4 man-weeks of effort were expended to catalogue, label, package, palletize, shrink-wrap, and ship 500 ft^3 of records. At $110/hr this amounts to $35/$ft^3$. It is estimated that there are 75,000 ft^3 of DOE-owned GDP records and GDP drawings located in the first and second floor X-100 vaults (Centrifuge-related records and drawings are expected to be or have been relocated to either the X-3012 or the X-1000 facilities per ACP prerogative). It is estimated that 95% of the remaining records can be sent off site at a cost of $2.5M. Significant efforts to declassify records are not expected to be cost effective and thus are not planned for or recommended. The 5% estimated (3750 ft^3) residual records and drawings needed by this go forward plan should be relocated to a facility within the new security access control fence (Sect. 6.3.6). One convenient location for these would be an abandoned area control room (ACR) in the X-326 building (perhaps ACR 4). Since it is likely that the ACRs do not meet DOE standards for security, the remaining classified documents will have to be located in approved safes within the ACR. With the X-326 building expected to be the last process building to be D&D'd, this new records center should be able to remain in place until final disposition (send off/destruction) of the records is made. The ACR's do have climate control and sprinkler protection needed for records storage.

Determining what records to keep constitutes perhaps the most difficult aspect of any go forward plan for records reduction. A recommended approach would be to establish a set of GDP D&D objectives based sorting criteria and assemble a group of subject matter experts to sort the records using this criteria. A preliminary listing or examples of sorting criteria might include the following:

- Required for post D&D remaining system/facility (X-530, X-6619, etc.);
- Required to identify and isolate energy sources during D&D;

- Required to support code requirements for fixtures, cranes, and structures during D&D;
- Required to support ongoing safety and security system operations during D&D (CAAS, fire sprinkler systems, alarm and surveillance systems, etc.);
- Required for safe removal and handling of major process equipment; and
- Required for disassembly of process components *if* size reduction as part of D&D is to be attempted.

The accomplishment of this sorting process or triage can begin immediately as soon as the criteria is established, agreed upon, and the subject matter team is assembled.

6.4 SEQUENCING OF ACTIVITIES

Most of the specified actions are independent in regards to when they can occur. The progression of activities does however have a logical sequence that constitutes a more or less optimum path for minimizing DOE costs and maximizing the enabling of D&D. There are two defining time regions to consider. The first is the period prior to USEC completing the two DOE-funded programs of deposit removal and Tc^{99} cleanup (both estimated to be complete before or during 2008). The second period is after the programs are complete but before the main demolition of the process equipment and buildings begins (pre-D&D). Discussions of each system in Sect. 5 and Sect. 6 of this report place the activity in the respective pre- or post-time frame. The following discussion attempts to describe a sequence within each or these time frames.

6.4.1 Period Prior to Completion of Programs

There are no total utility deactivation opportunities during this time frame due to the continued need for some small amount of the commodity the utility provides. Consequently, prescribed activities during this period focus on realizing conservation and other savings with each utility. These efforts and activities are mutually exclusive in that they can begin and be accomplished simultaneously on a best effort basis by the USEC organizational unit or whoever has responsibility. Many of these activities will require USEC maintenance effort. There may be resource constraints with maintenance forces. Sequencing these actions based on USEC maintenance force availability is beyond the scope of this effort.

Engineering, planning, funding, construction, and other preparatory activities for projects that enable a utility's partial or total shutdown could and should take place during this time frame. Specific projects that can and should begin (and ideally be completed) during this time frame are:

- New X-6000 (X-7721) to Scioto River Blow-down Line;
- Alternate power feed from the X-530 to provide for critical X-533 loads;
- Supervisory Control and Data Acquisition, Incremental Power Demand Computer, and office modifications to allow relocation of Power Operations to the X-530;
- X-533 OVEC line termination redesign;
- Alternate heating of buildings for freeze protection;

- Alternate heating of buildings for personnel occupancy;
- Alternate cooling for the X-300 and X-530;
- CAAS cluster heating system (for unheated buildings);
- Retrofit the X-326 (and possibly X-330) sprinklers to dry-pipe design;
- Fencing modifications for streamlined access;
- X-100 vault records reduction triage;
- Stand alone air compressors for future residual demand;
- Fire fighting assessment by AHJ for allowing termination of sprinkler protection;
- Design for "trailer city" for D&D contractor housing and warehouse cleanup/removal; and
- Renovating the X-700 or possibly the X-720.

6.4.2 Period Following Completion of Programs

Upon completion of the DOE-funded programs and completion of the respective precursor activities listed in Sect. 6.4.1 of this report, a logical progression of activities is as follows. Note that the sooner the action can be taken, the sooner the recurring savings associated with the action will start to be realized.

- Depopulate densely populated facilities (X-100, X-101, X-102, X-705, X-710, and X-720);
- Populate X-300, X-700, and possibly X-720;
- Establish classified records vault in exclusion zone;
- Empty the X-100 Vault;
- Shutdown the X-533 Switchyard (can be accomplished before if all precursors accomplished in an expeditious manner);
- Relocate Power Operations to the X-530 Switchyard;
- Shutdown the X-600 Steam Plant;
- Shutdown the RCW system;
- Shutdown the Nitrogen System;
- Shutdown the Dry Air Plants; and
- Shutdown the X-611 (if purchase of water chosen).

7. UNCERTAINTIES

There are several uncertainties or unknowns that have the potential to change the economics and timing of these studies. The conclusions are; however, generally forgone. Some of these uncertainties with their potential impact are discussed in the following sections.

7.1 ELECTRICITY COST

As stated in the current operations section, there is significant volatility in the current and projected cost of electricity. Recent inquires have shown peak demand purchase costs potentially being as high as $80/mWh as compared to the projected $50/mWh. Current purchase costs are approximately $41/mWh. The impact of this significant higher price would be the following:

- Increased incentive to install dry-pipe sprinklers versus the continued electrical heating of large spaces for sprinkler freeze protection; and
- Delivered unit costs of all utilities will be higher and thus the urgency to adopt conservation/ conversion methodologies increased. The cost of the residual demand electricity component will also be proportionally greater.

7.2 USEC LABOR COSTS

These studies were all based on a cost to DOE of USEC supplied labor of $110/hr. While this was the approximate rate at the beginning of the studies, the current labor rate appears now to be approximately $145/hr. Applying this new rate to the analysis will serve to enhance the savings with the proposed economies and increase the urgency to accomplish the proposed changes.

7.3 CAAS SYSTEM

The CAAS is considered in this study to be indispensable as a safety system with no clear cost effective alternative system or process to negate its need. As such, two facilities (the X-700 and X-300) required to remain populated and functioning until the last fissile facility is D&D'd. If a low cost comparably effective alternative to providing this safety function could be developed and implemented, the need for the X-700 could be eliminated and the residual functions of the X-300 more easily relocated.

7.4 DECONTAMINATION FACILITY

The X-705 facility contains the only plant-site chemical processing capabilities (solution recovery) to convert aqueous and other uranium solutions to uranium nitrate hexahydrate (UNH) and to denitrify/dehydrate (calcine) these solutions into uranium oxide. The final step required to converting uranium oxide to UF_6 feed material (oxide conversion) has not been operated for 20+ years and the existing process is deemed unsafe. The capability to make UNH or uranium oxide from uranium bearing solutions is not anticipated to be needed during D&D since only minimal or no wet decontamination of removed equipment is expected. It is anticipated that the limited amount of field generated liquid decontamination solutions can be shipped off site to another DOE facility for processing or be

treated/evaporated using a less costly field process. In the event that these assumptions prove invalid, the need to retain the X-705 facility in operation should be revisited.

An additional though remote possibility for a DOE beneficial X-705 mission would be to process the uranium bearing materials contained in the X-744G (Uranium Management Center) to a form that could be more readily sold or disposed of. The economics of such a program would require consideration of the cost of keeping or replacing the X-705 utilities of steam, sanitary water, dry air, nitrogen, and electricity.

7.5 ORDER OF PROCESS BUILDING D&D

Throughout this report it is assumed that the sequence of process building D&D will be: (1) the X-333, (2) the X-330, and (3) the X-326. This is based on the assumption that the greater than always safe mass deposits in the high assay equipment will not be mitigated before D&D start and thus greatly complicate the D&D process. Thus, the easiest are expected to be done first. If this order was to be reversed, (perhaps because some early efforts at NDA quantification improvement or deposit removal resulted in the X-326 becoming less than a Category 3 nuclear facility) those facilities in the infrastructure required to support X-326 S&M could be shut down substantially earlier (perhaps 10 years earlier). Facilities impacted would be the X-700 and the X-300. The order of the dry-pipe sprinkler conversion attractiveness would also be reversed with the longer standing X-333 and perhaps the X-330 being converted with the X-326 not being converted.

8. CONCLUSIONS AND RECOMMENDATIONS

Conclusions reached with this study are that opportunities now exist for operational and other changes to be made in the Utilities and Power Supply Systems that will immediately result in as much as $4M/year ($5.4M/year including non-utilities savings) operating cost being saved. Of the $4M/year, savings of $2.9M/year ($3.3M/year including non-utilities savings) can be realized with essentially no expenditure. The needed changes can be made without impacting ongoing DOE/USEC programs. Implementation of these changes will require a willingness to move beyond past practice and to make changes that will be difficult and unpopular. It is recommended that the near term savings be used to fund engineering and other preliminary work needed to implement the full scope of savings.

A road map forward is provided that results in partial or total shutdown of the Dry Air, Nitrogen, Water, Steam, and RCW systems and has been shown to result in a yearly savings of approximately $18M/year after completion of the deposit removal and Tc^{99} cleanup programs. Initial residual cost during D&D will be $8.3M/year and will diminish as facilities are demolished and D&D contractor personnel demobilized.

9. REFERENCES

TPMC (Theta Pro2Serve Management Company, LLC) 2005a. *Environmental Management & Enrichment Facilities,Cold Standby and Transition Planning, RCW Systems, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-5, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005b. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Electrical Switchyards Assessment, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-8, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005c. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Steam Systems, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-9, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005d. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Dry Air Systems, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-10, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005e. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Raw, Sanitary, and Makeup Water Systems Assessment, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-11, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005f. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Process Building Dry Sprinkler Systems, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-33, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005g. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, Nitrogen System, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-35, Piketon Ohio.

TPMC (Theta Pro2Serve Management Company, LLC) 2005h. *Environmental Management & Enrichment Facilities, Cold Standby and Transition Planning, X-6619 Sewage Treatment Facility, Portsmouth Gaseous Diffusion Plant,* TPMC/PORTS-37, Piketon Ohio.